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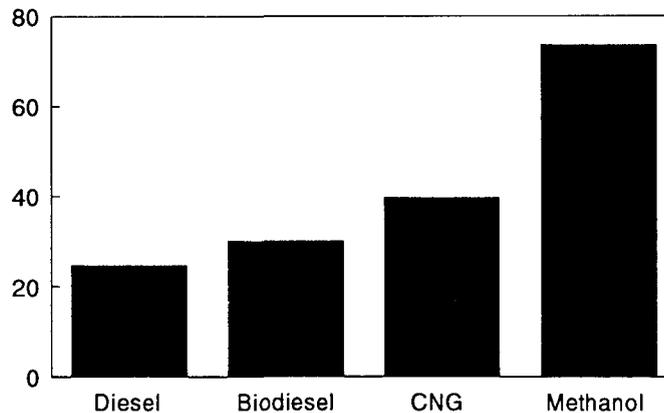
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# Industrial Uses Of Agricultural Materials

## Situation and Outlook Report

### Biodiesel Is Potentially Competitive With CNG and Methanol as an Alternative Fuel for Transit Buses

Estimated total present value costs per bus per mile (cents)



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## Summary

### *Research and Market Demand Open New Opportunities for Agriculturally Based Industrial Materials*

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USDA's Alternative Agricultural Research and Commercialization Center has begun receiving royalty payments from two companies. The Center makes repayable investments in private firms to commercialize new industrial (nonfood, nonfeed) uses for agricultural and forestry materials and animal byproducts. Center funding was \$6.5 million in fiscal 1995, and 10 projects are scheduled to receive funds.

USDA's Agricultural Research Service signed its 500th Cooperative Research and Development Agreement (CRADA). CRADAs allow joint collaboration between government scientists and industry to develop particular discoveries.

USDA's Cooperative State Research, Education, and Extension Service continues to work with the U.S. Department of Defense on the Advanced Materials from Renewable Resources Program. Coordinated by USDA's Office of Energy and New Uses, USDA and the U.S. Department of Energy (DOE) plan biomass demonstration projects for fiscal 1996. As part of its Alternative Feedstocks Program, DOE has signed agreements, including CRADAs, with private firms to develop polyols, a plastics monomer, and long-chain dicarboxylic acid monomers from renewable materials.

If biodiesel is approved as a certified technology for the Urban Bus Retrofit Rebuild Program, U.S. transit operations would be able to use it to meet air-quality regulations without any change in operability and maintenance. In the European Union, biodiesel production and commercial use expanded in 1994 and is expected to intensify in 1995.

A special article examines the expected costs of operating a transit bus fleet on three different alternative fuels—biodiesel, compressed natural gas (CNG), and methanol—with petroleum diesel as the base fuel. New fuel storage, delivery, and operating systems would be needed to use methanol or CNG, but no infrastructure changes or engine modifications would be necessary for biodiesel. Using a discounted present-value analysis, the total cost per bus per mile was estimated for the 30-year life of a transit fleet. Diesel buses had the lowest cost at 24.7 cents per mile. As biodiesel is blended with diesel, the cost per mile ranged from 27.9 to 47.5 cents, depending on the amount of biodiesel used and its estimated price. CNG's cost varied from 37.5 to 42 cents per mile, while methanol's cost was 73.6 cents per mile. This analysis indicates that, although biodiesel and biodiesel blends have higher total costs than diesel fuel, they have the potential to compete with CNG and methanol as fuels for urban transit buses.

The U.S. Gross Domestic Product (GDP) is expected to grow between 2.8 and 3.2 percent in 1995, down from 1994's increase of 4.1 percent. GDP growth for 1996 will range

from 2.0 to 2.6 percent over 1995, with manufacturing output rising 2.6 to 3.0 percent during the year. Industrial markets for agricultural materials should grow somewhat slower than overall manufacturing for the next 6 quarters.

Industrial uses of corn are expected to total 780 million bushels in 1995/96, up 4 percent from the current forecast of 753 million for 1994/95. Most of the increase is expected to be in the production of fuel alcohol, up 4 percent, versus only a 2-percent rise in industrial starch. Ethanol sales in the reformulated gasoline market have been strong, despite the court-ordered elimination of the renewable oxygenate requirement. Several companies are manufacturing biobased polymers using starch, polyhydroxybutyrate/valerate, and polylactic acid. Cornstarch also is used to make xanthan gum, a popular ingredient in food, pharmaceuticals, and industrial products.

About 90 percent of collected cotton linters and motes are transformed by chemical or mechanical means into hundreds of diverse products, while only about 5 percent of cotton lint is used in industrial applications. In 1994, an estimated supply of 10.8 billion pounds of cotton lint, linters, motes, and textile wastes were available for industrial purposes.

Immunized dairy cows are producing antibodies that can be used to treat gastrointestinal tract infections. Transgenic goats and cattle are being developed to produce proteins—such as antithrombin III, human-serum albumin, alpha-1 proteinase inhibitor, and human lactoferrin—used in the treatment of infections and diseases. Dairy products also are used to produce low-cost, optically pure chiral intermediates for the pharmaceutical, food, and agricultural chemical industries.

The use of wood for energy is projected to reach between 2.8 and 3 quadrillion BTU's in 2000. The forest products industries themselves are the major users of wood for fuel, accounting for 71 percent of wood fuel consumed in 1992. Residential use, utilities, and other industries consume the remaining 29 percent. Production of liquid fuels from woody biomass is not economical at this time, but research is being conducted to lower costs.

Essential oils and their derivatives are widely used as flavors and fragrances, a market estimated to be worth \$9 billion. In 1994, the United States exported essential oils valued at \$176.1 million, while importing \$206.7 million. U.S. production of peppermint and spearmint oils in 1994 were 7.4 and 2.2 million pounds, respectively. Supplies of orange oil and d-limonene, which are highly dependent upon orange juice production in Brazil and the United States, could continue to be tight into 1996.